F/A-18
Automated Maintenance Environment

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Global AME Environment (Sea Power 21)

F/A-18 A-G

MIDS

Maintenance Data

MFOQA

Systems Engineering

CVLAN

OPs

SMART TPS

I, D, OEM

CASS

FAME

Supply

Flight Deck Handler

Background

AME 101

F/A-18 AME - Objectives

- Increase the operational readiness of our airborne forces by reducing the maintenance cycle time and providing total asset visibility for better logistic forecasting.

- Reduce the cost of maintenance by reducing the cycle time through better diagnostics and access to information.

- Improve the quality of the maintenance data collected to improve future aircraft system performance and maintenance processes.

F/A-18 AME - What is it?

- The AME is a suite of integrated software designed to support the organization level aircraft maintenance activities and upper management organizations by providing better decision support to the maintainer and improved data collection for performance analysis. AME provides:
  - Aircraft data stripping and analysis tools
  - Ground based Integrated Diagnostics (ID) to rapidly evaluate aircraft data and determine the appropriate corrective action
  - An integrated Maintenance Management System (OOMA/Tracker) to minimize data entry and improve data collection
  - Class IV Interactive Electronic Technical Manuals that provides context filtered access to maintenance and troubleshooting providers
  - A feedback mechanism for technical data enables a shorter improvement cycle
  - Support for Data warehousing/mining to enable ready access to the maintenance data for analysis and reports

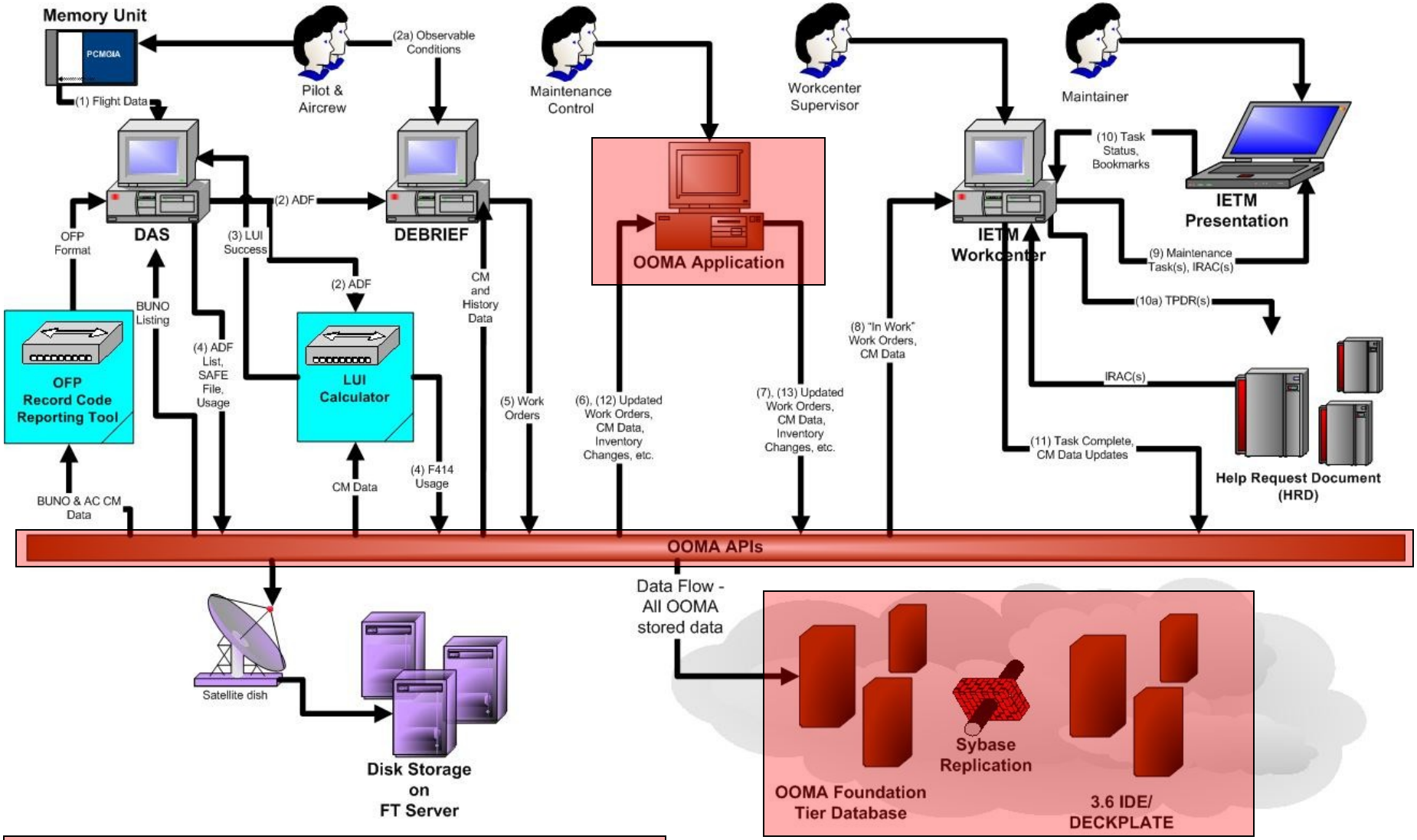
What can an AME do for you?

- Increased efficiency and effectiveness of Maintenance Actions through:
  - Reduced Troubleshooting Turn-Around-Times (TAT)
  - ID processes increase the effectiveness of the ‘average’ maintainer
- Automated Trending & Analysis (real and near-real time)
  - Overall Aircraft Health
  - Subsystem Health
  - Component level elements
    - “Bad Actor” Serial Numbers
    - High Usage indicators
- Data Mining for complex issue correlation
  - Environmental impact on aircraft & systems
  - Multiple system failure indications resulting in a single point of failure
  - Pilot Impacts on Aircraft Maintenance requirements (Flight Replay)

What can an AME do for you?

- Inventory and Configuration Management
  - Identification of Inventory for Parts Obsolescence replacement, ECP effectivity, Alternate part review, etc.
  - Management control of the A/C and assets
  - Key component of the Total Asset Management paradigm
  - Ability to assess mission capabilities
  - Parts on time
- Supply Forecasting
  - Reduced spares costing, through economies of scale
  - Accurate Usage rates/Spares requirements
  - Parts Obsolescence/Upgrade timeline

F/A-18 AME Process Overview



FMS needs alternate MMIS

(s)AME vs. FAME

What's this (s)AME, FAME stuff?

- **(s)AME** is the integrated maintenance support system specific to the F/A-18 today, a.k.a. Superhornet AME

- **FAME** is the future integration of (s)AME with NALCOMIS OOMA, a.k.a., F/A-18 AME

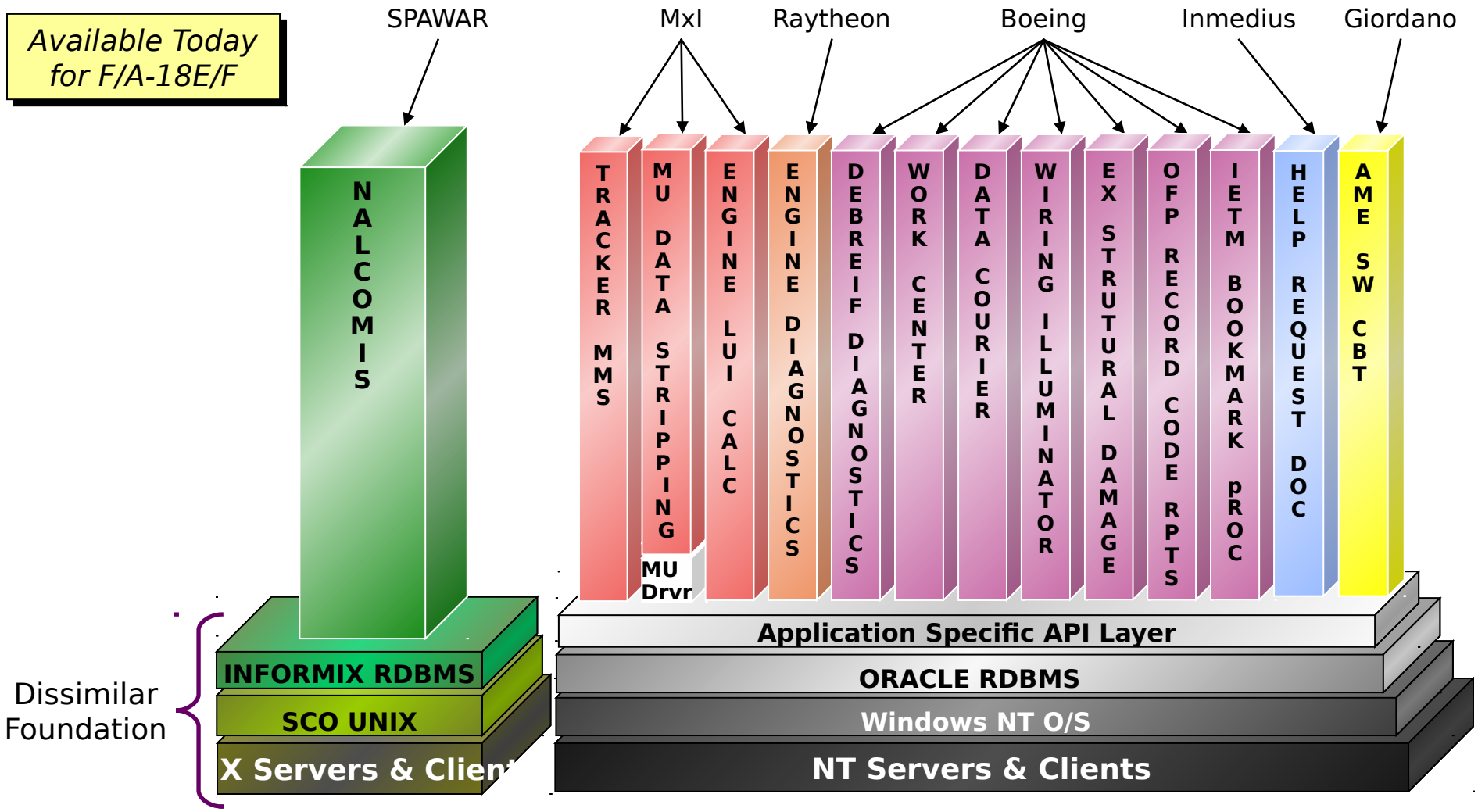
F/A-18 AME Configurations

- **Interim Solution = (s)AME**
  - Deployed today at all F/A-18 squadrons and AIMDs
  - Integrated maintenance support system specific to the F/A-18
  - Uses COTS maintenance management module (Tracker)
  - Legacy NALCOMIS still system of record - dual documentation required for engines.

- **Final Solution = FAME**
  - Development In work
  - Integration of (s)AME components with NALCOMIS OOMA
  - Provides complete equipment, maintenance, and usage data
  - Eliminates dual documentation

(s)AME Configuration (E/F)

Available Today for F/A-18E/F



(s)AME Configuration (A-D)

As Deployed Today for F/A-18 A/B/C/D Engine CM (Commonly Referred to as the "ECAMS Replacement")
F-404-GE-400/402

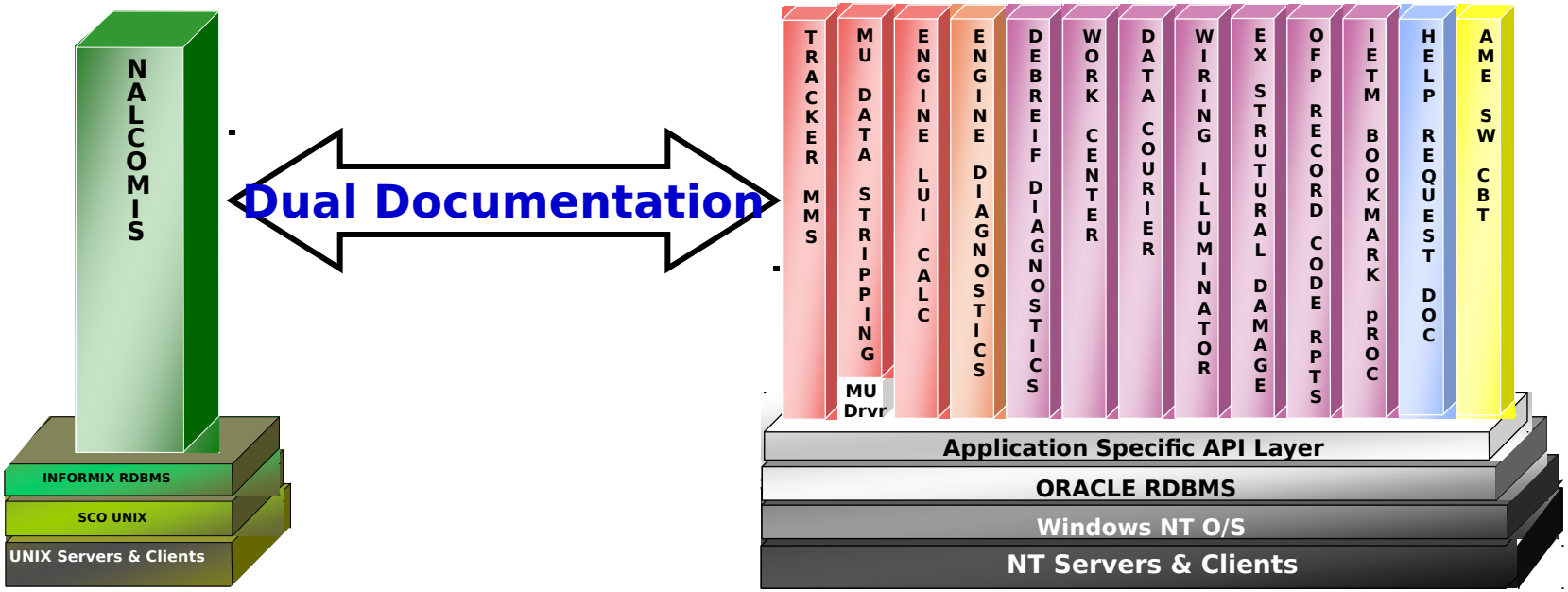
Paper Logset

Paper Pubs

- Engine Data is the Primary Concern for A-D in the (s)AME World
- Paper Pubs are Still Used, Although IETMS are nearing completi

(s)AME Status

- Dual Documentation
  - NALCOMIS system of record, Tracker is not
  - any discrepancies generated from Tracker must be manually entered into NALCOMIS and signed off to comply w/4790

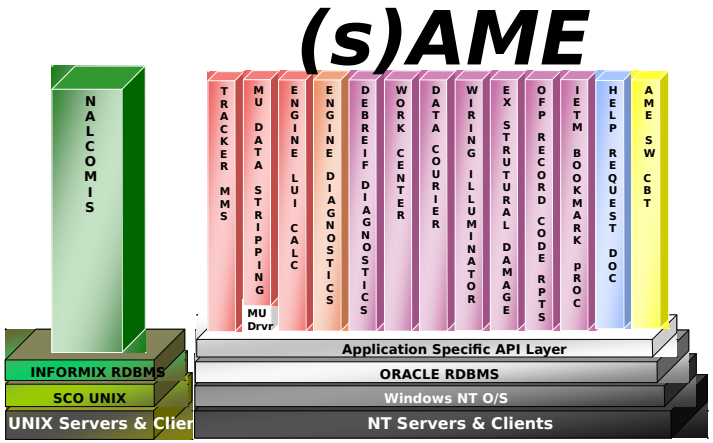


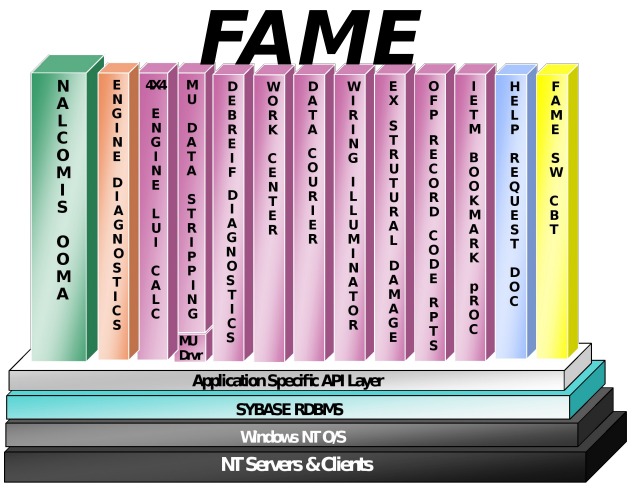
(s)AME Status

- (s)AME life cycle 3 to 5 more years assuming OOMA/FAME success
- Team met in May to discuss path to retirement
- Summary of Agenda Items Discussed:
  - Requirements (assumption that OOMA will be there)
  - Overall Team Roles and Responsibilities
  - Connectivity and Data Transfer
  - Engineering Data volume Requirements
  - Proper use of the System
  - Hardware
  - Software
  - PLTS
  - Fleet Support
  - Training
  - Certifications
  - SIGMA

(s)AME/FAME Differences

- CM Module
  - (s)AME = Tracker (COTS)
  - FAME = OOMA (SPAWAR NTCSS)
- Baselines
  - Tracker – engine centric/PMIC parts only
  - OOMA – complete aircraft (WUC based)
- Architecture Dissimilar
  - (s)AME = Oracle DB
  - OOMA/FAME = Sybase DB
  - FAME requires rehosting of F/A-18 specific apps and new API layer to integrate w/OOMA





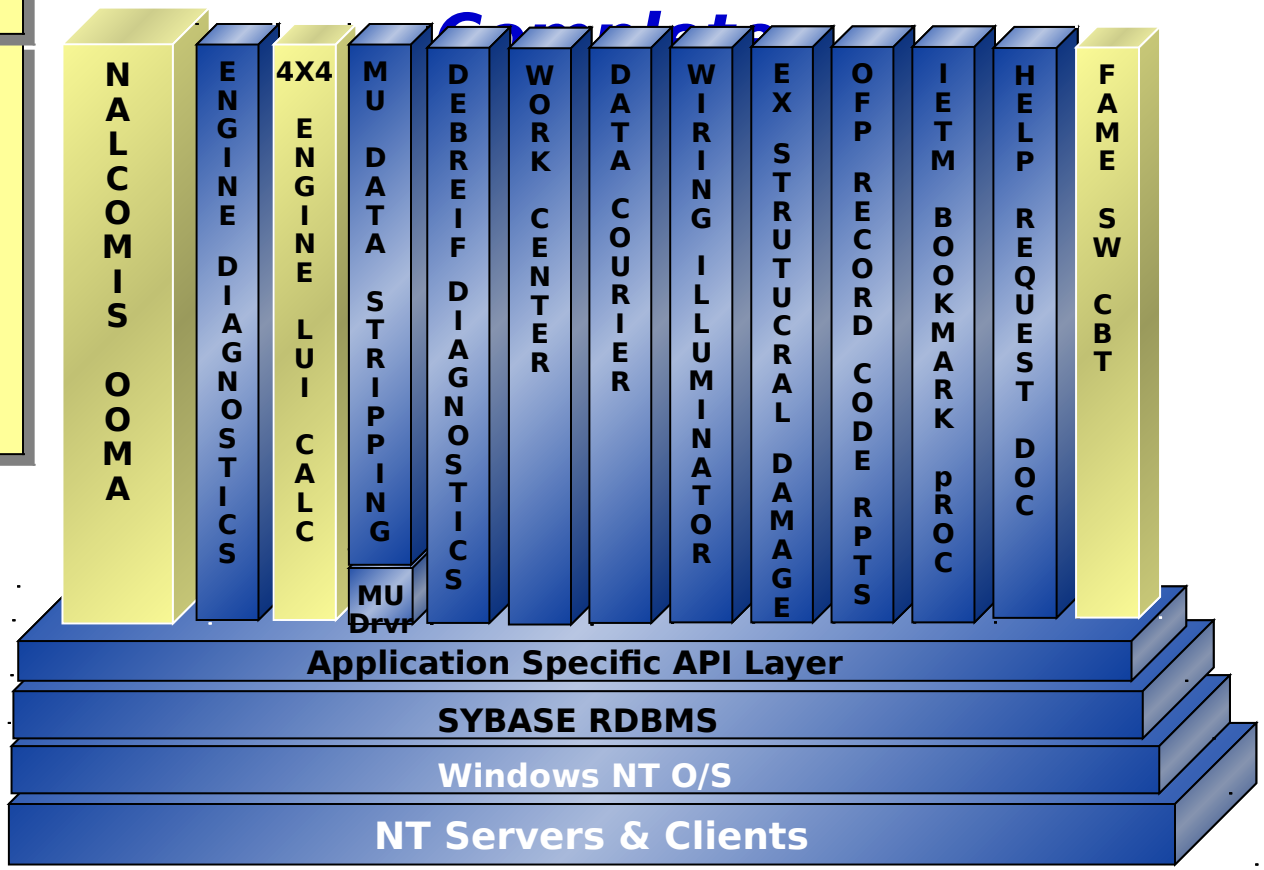
FAME S/W Development Status

Software Approximately 85% Complete

Desired End State for F/A-18 A-F

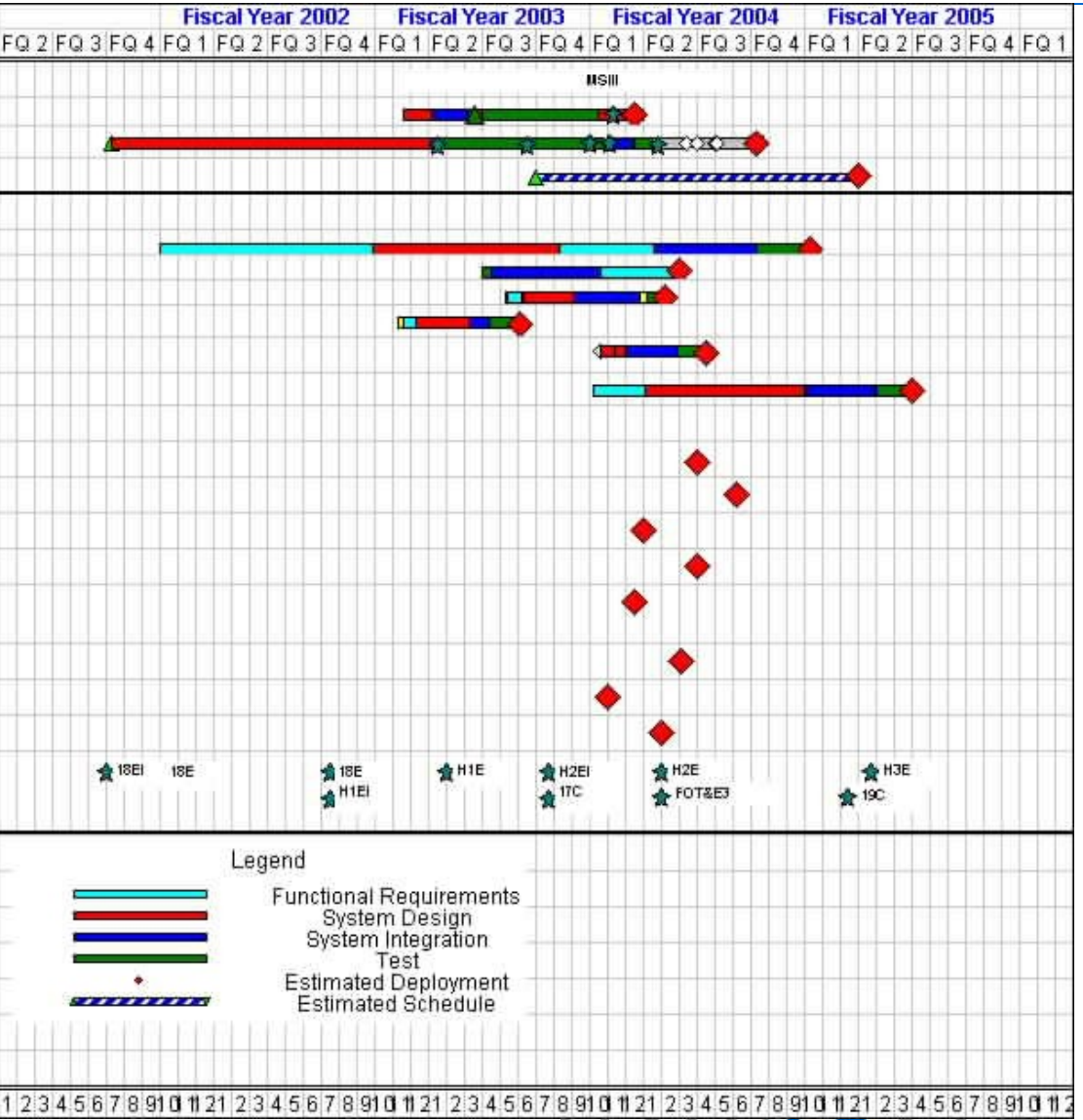
In Process:

- *OOMA DT/OT*
  - *-Version 03.05 Release*
- *4X4 LUI CALC (Test Build)*
- *MU Driver Updates (Done)*
- *Data Migration Tool (In Test)*
- *IETM for F/A-18A-D (FY05)*



FAME Schedule

	Start Date	Finish Date
OOMA		
Version 03.04.10	11/20/02	12/31/03
Version 03.05	7/9/01	7/9/04
Version XX.XX	7/1/03	12/31/04
FAME		
Version 1.0	10/1/01	10/8/04
LUI F4x4	4/9/03	3/2/04
Data Migration Tool	5/9/03	2/6/04
MU Driver Update	11/11/02	6/4/03
Implementation Training Dev	10/20/03	4/16/04
Version 2.0	1/5/04	4/1/05
Baseline		
F/A -18 A-B Dev Complete	4/1/04	
F/A-18 A-B QA Complete	6/1/04	
F/A-18 C-D Dev Complete	1/1/04	
F/A-18 C-D QA Complete	4/1/04	
F/18 E Dev Complete	12/15/03	
F/A-18 E QA Complete	3/1/04	
F/A-18 F Dev Complete	11/1/03	
F/A-18 F QA Complete	2/1/04	
SCS Releases	7/1/01 10/1/01 7/16/02	



AME Issue Summary

- Software
  - **FAME**
    - S/W development essentially completed. Integration testing and certification in work
  - **sAME**
    - Engine PLTS Reports
  - **BIT Reliability**
- Policy & Directives
  - 4790 & NA-00-25-100 need to be updated to address the use of IETMs and the AME tools set
  - NAVAIR 3.6 common PEDD policy under NMCI
- Infrastructure
  - NMCI certification and accreditation of AME / IETM software in work
  - RMMCO certifications for shipboard use
  - Concerns over power & network drops to support PEDD operation aboard ship
- Schedule
  - A-D Site Activation schedule in flux. Close coordination between PMA-265, Wing, TYCOMs and contractor is essential to succeed.
  - OOMA 03.04 DT/OT completion, release of 03.05
- Training
  - Completion of comprehensive AME training package
    - Integration to NAMTRAU for sustainment
    - Integration with OOMA/FASO – (in-work)

Background

False BIT 101

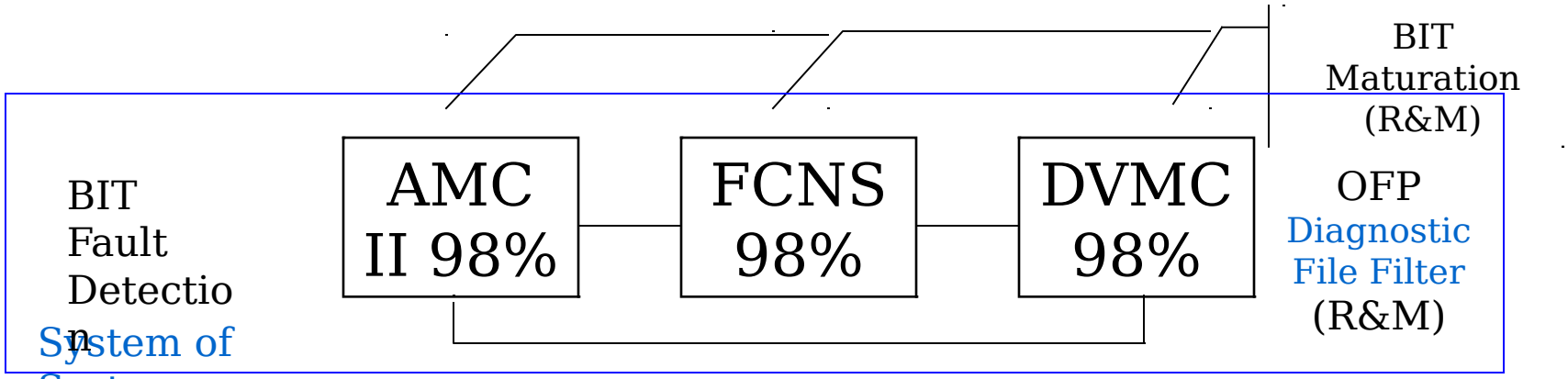
False BIT Impact

- F/A-18 Maintenance Concept not completely followed due to:
  - **Lack of Confidence** in aircraft level BIT system resulting in:
    - Reduced Aircraft Availability A_o
    - Aircraft Mishaps (Class A=3 lost aircraft w/fatalities)
    - High AVDRL Costs - Repair of Repairable (ROR)
    - Increased CND's (A 799)
    - Higher Maintenance Man-hours at all levels
      - Increased Trouble-shooting requirements
      - Increased R&R
      - Repeative Maintenance

False BIT Impact
(cont)

- Why the confidence problem in aircraft level BIT system?
  - BIT/IETMS Maturation process personality based vice policy based
    - 88% False Alarm rate in C/D (Lot 18 – 20) aircraft, Mean Flight Hour Between False Alarm (MFHBFA) rate of .99 (25 years of a broken system)
    - E/F at completion of EMD had significant improvement in MFHBFA rate of 24.7 hrs, however, disestablishment of BIT Evaluation process (maturation) resulted in Lot 24 aircraft MFHBFA reduction to 2.3 hrs.
  - Reestablishment of BIT Evaluation (maturation) process resulted in:
    - Lot 25 BIT Evaluation Team Improved MFHBFA from 0.6 to 9.9 from Oct ’02 to Apr ’03 (excluding EW systems).
    - Current Status at systems engineering level:
      - Lot 26 BIT Evaluation Team in-work with flight test community

False BIT Compounding



Fault Detection of the Series of Systems (System of Systems)

94 %

False BIT Factor in Aircraft Mishaps

- Analysis: Multiple Mishaps directly correlated to lack of confidence in BIT indications and/or understanding of system (SAR: 54-005 Excessive BIT False Alarm Rate)
- Recommendations:
  - Standardized MSP Code List providing Go/NoGo criteria (derived from engineering analysis and Fleet experience)
  - Standardized aircraft Safe For Flight (SFF) Release process changes:
    - **Maint. Control CPO "Initial SFF Release after review of ADB"**
    - **Flight Deck/Line (SFF qualified person) "Prior to Flight SFF Release" based on final review of "preflight MSP codes and Hydraulic system status card" (BIT Card data)**
  - MSP Code Trend Analysis performed on a flight by flight basis with results **"Integrated into Maint. Control Desk CPO's SFF Release Process" (Recommend Automating this process within (s)AME and FAME)**

Combined Top 15 lists Ranked by #A799s

	AC Applicability	WUC	A-799 QTY	A799 MHRS	CANN MHRS	PART NUMBER	NOMENCLATURE	TOTAL 2002 AVDLR COST
1	A-D	57D9100	545	2294.6	759	936E918G1	ROLL-PITCH-YAW CMPT	$ 1,794,434.00
2	A-F	742G100	495	3975.3	947	135312-1	RADAR TRANSMITTER	$ 13,356,543.00
3	A-F	73MZ100	322	2673.9	148	886401-4	INERTIAL NAV UNIT	$ 1,483,280.00
4	A-D	74N7700	274	671.2	57	KY853/AYQ9	CMD SIG ENCDR/DCDR	$ 838,100.00
5	A-D	7468100	268	1002.7	452	IP-1317/A	DIGITAL DISPLAY INDICATOR	not available
6	A-D	761S100	243	1915.3	182	39000-49	CM COMPUTER	$ 724,333.00
7	A-D	4115700	192	992.9	43	625416-3-1	ACS TEMP/FLW ELEK CONTROL BOX	not available
8	A-D	751B600	145	794.6	12	3188AS100	GUIDED MISSILE LAUNCHER	$ 178,184.00
9	A-F	74Y4W00	140	564.8	744	129000-29	DIGITAL DISPLAY INDICATOR	$ 6,830,760.00
10	A-D	4211800	136	1313.8	483	971E325G1	GENERATOR CONVERTOR UNIT	$ 3,822,783.00
11	A-D	67X2300	134	575.8	251	A05A0227-5	ELECTRONIC EQPT CONTROL	$ 2,078,058.00
12	A-D	64X1G00	127	634.4	161	5150100-1	INTERCOM AMPLIFIER-CONTROL	$ 2,460,978.00
13	A-D	74D6100	127	497.1	330	37000-59	HEAD-UP DISPLAY UNIT	$ 2,637,144.00
14	A-D	754CD00	126	444.2	21	1534AS100	ACFT BOMB EJECTOR RACK	$ -
15	A-D	761S800	124	783.4	85	31-052164-02	RADAR RECEIVER	$ 656,689.00
16	E-F	74B2100	35	158.2	46	3525046-110	RDR DATA PROCESSOR	$ 2,106,755.00
17	E-F	766Y200	30	110.3	14	179730-0004	ELEK CMD SIG PRGMR	$ 20,573.00
18	E-F	74B2300	29	115.5	58	3525683-110	APG73 POWER SUPPLY	$ 819,810.00
19	E-F	74P8200	26	88.5	100	82371-01	SIG DATA CONV-CONT	$ 108,752.00
20	E-F	73X3300	24	126.3	45	138000-9	COMPUTER DISPLAY	$ 2,634,936.00
21	E-F	7400000	23	67.6	42	SYS	WEAPONS CONTROL SYSTEMS	not available
22	E-F	57DA100	10	158.2	11	111E9359G5	ROLL-PITCH-YAW CMPTR	$ 1,120,944.00
23	E-F	722C100	10	46.4	16	HG7194A1	APN194 RECIEVER-XMTR	$ 259,650.00
24	E-F	41E1100	8	11.5	3	814237-2	ACS CONTROLLER	$ 4,260.00
25	E-F	5839200	6	16.1	6	761-101000-11	ACFT MAINT INDICATOR	$ 15,000.00
26	E-F	653D100	6	153.6	111	1007101G-10	RADIO RCVER-XMTR	$ 1,107,466.00
27	E-F	73X4Q00	6	38.2	2	138000-19	MULTI-PURPOSE COLOR DISPLAY	not available
	TOTALS		3611	20224.4	5129			$45,059,432.0

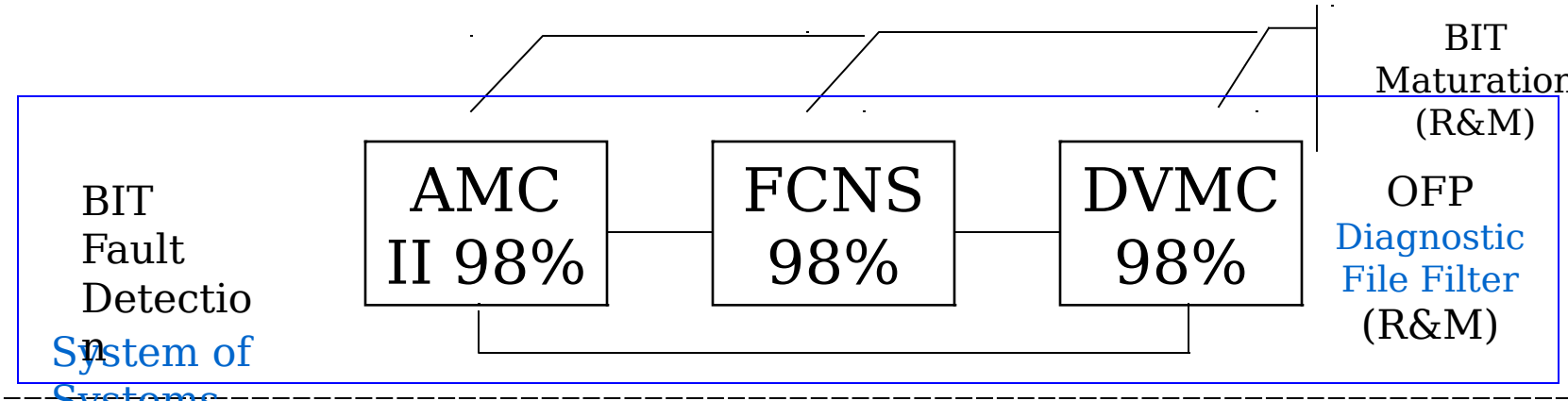
BIT Solutions…

Trend Analysis Process =Results = "Aircraft Ready for Training"

- **Trend Analysis Proof of Concept:** During my tour with VFA-131 from January 1999 – August 2002, I was the Maintenance Control Supervisor. Based on my experience with the E/F EMD BIT Team, I performed aircraft level (& subsystem level i.e. FLIR, RADAR) MSP Code Trend analysis on a flight by flight basis, on a spreadsheet. This process provided for me a methodology for consistently evaluating the health of the aircraft and the basis for making "proactive" opportunistic maintenance decisions resulting in: **VFA-131 averaging 68 Flight Hours and 44 Sorties more per month than all the squadrons assigned to CSFWL from January 1999 – July 2002. (Excluding Flight Hours/Sorties flown in support of OEF)**

- VFA-131 C-1 "Combat Ready" 6 months prior to deployment date (Sep '01 vice Mar '02 – 33% faster than scheduled)
- VFA-131's Maintenance Department received "Best of the Best" AMMT (2001)
- VFA-131's Maintenance Department recognized as finest evaluated for SFARP during his tour by Commander, Fighter Weapons School Atlantic (2001)
- VFA-131's FLIR availability rate highest average by AIRLANT ('00, '01, '02)
- VFA-131 CY 02 Battle "E", Safety, and the CAPT. Michael J. Estocin Awards

AME ID Interface



Design Interface

Fault Detection of (The Series of Systems)

94

Address:

- Sympathetic MSPs
- Cascading MSPs
- SAR/STR Correlation

AME Integrated Diagnostics

CMA to Actual Failed Item Accuracy

98

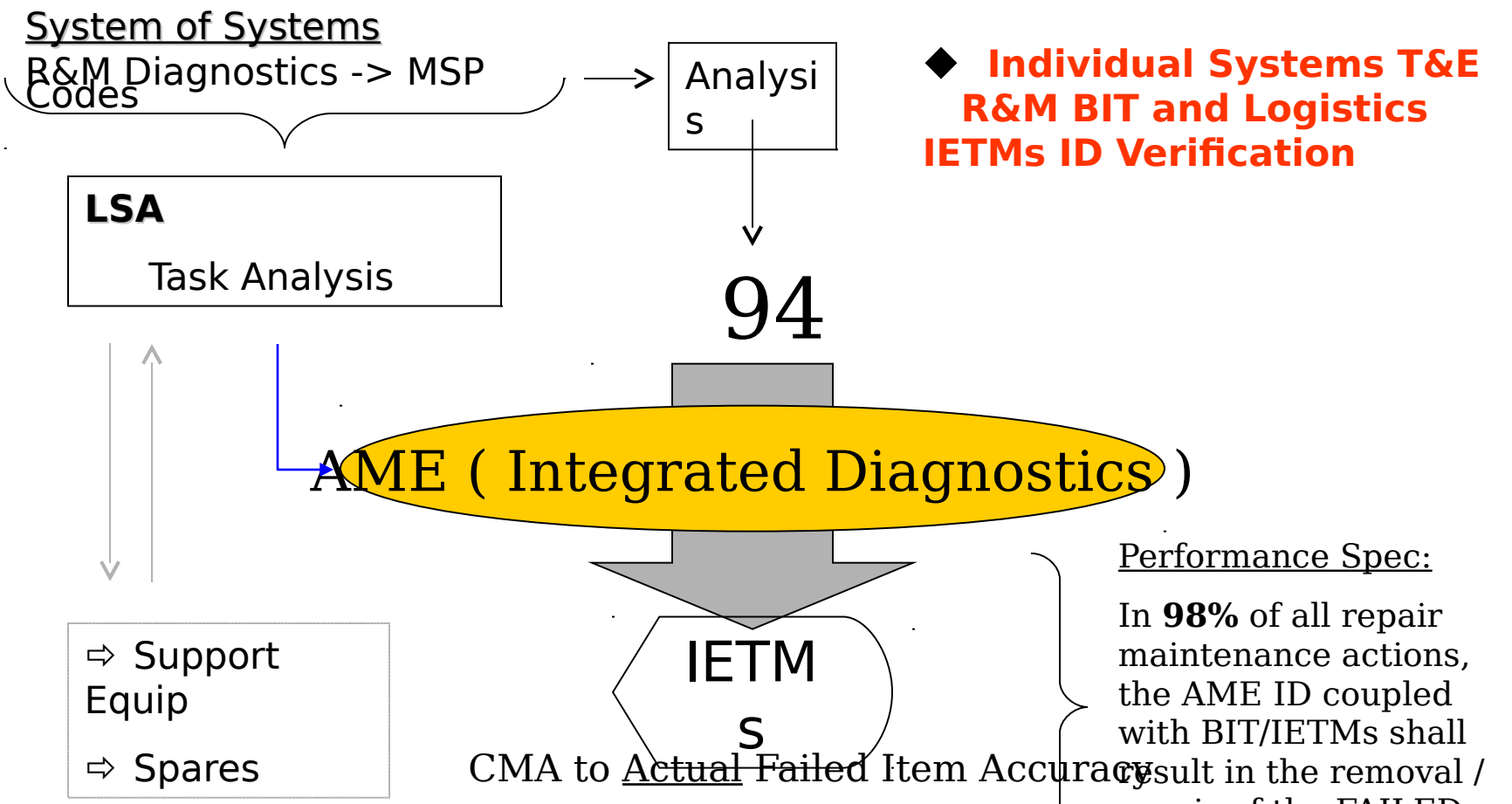
0%8

Performance Spec:

In **98%** of all repair maintenance actions, the AME ID coupled with BIT/IETMs shall result in the removal / repair of the FAILED item on the first iteration.

AME ID Interface

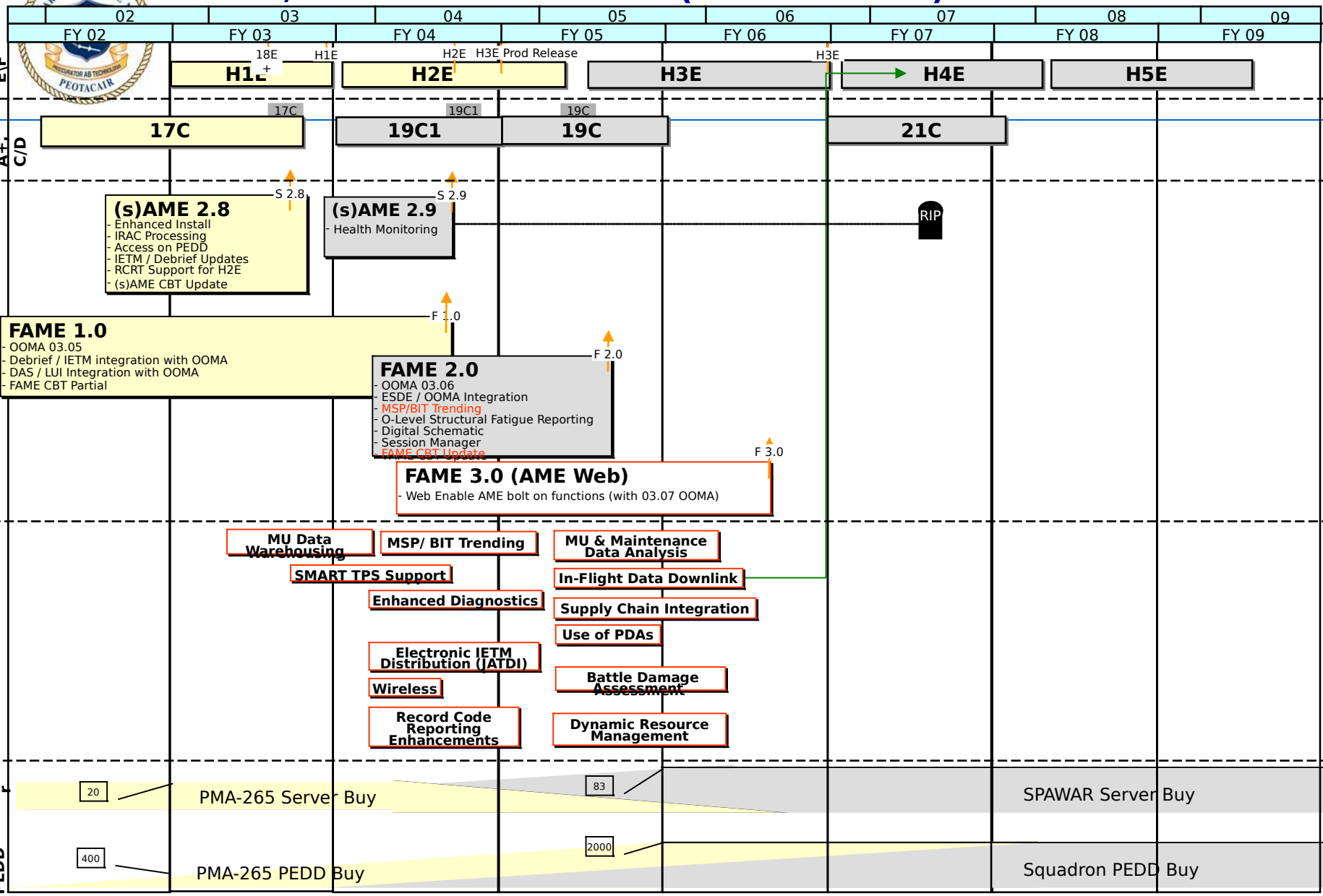
The Process



Success Requires:

- Funding and development of an Integrated Diagnostic (ID) Team responsible for maturation of:
- (1st Tier) Aircraft and sub-system level BIT (MSP codes, BLIN's, BOA's, Grey Codes)
  - Diagnostic File Filter rules (DFF) identified and implemented during RDT&E process with real-time fleet follow-up
- (2nd Tier) Integrated Diagnostics Rule set inherent in Debrief Function
  - Development of off-board ID rules to provide ID processing where the DFF cannot due to Cost, Schedule, Performance consideration
- (3rd Tier) IETM's processes and content. Provides opportunity to filter False Indications (BIT) through troubleshooting and rule verification
  - Verification required during RDT&E process

F/A-18 AME ROADMAP (FY 2000-2007) PLAN 01-0.1



Desired but Unfunded - POM/PR Issue
Planned but Major Funding Issue, Possible Slip
SCRB Final Approval
Approved but Slipping !

Submitted By: D. Scott 17 July, 2003

Approved By:

NAVAIR